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The Mineral Industry of Turkey

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This publication is a chapter from the current Bureau of Mines Minerals Yearbook, comprising *Volume I, Metals and Minerals; Volume II, Area Reports: Domestic; Volume III, Area Reports: International.* The separate volumes of the Yearbook are sold by the Superintendent of Documents, Washington, D.C. 20402.

The Mineral Industry of Turkey

By George J. Coakley[1] and Kevin Connor[1]

In a region dominated by fossil fuel production, Turkey possessed the largest nonfuel minerals industry in the Middle East. The mineral industry produced over 45 nonfuel minerals along with coal, natural gas, and petroleum. A world class producer of several of these minerals, Turkey ranked second in boron, producing about one-third of the world's supply. It ranked among the top three miners of strontium ore with an estimated 26% of world output in 1984. As the world's fourth largest producer of chromite, Turkey was responsible for 6% of the total supply of this material. It also ranked sixth in the world as a producer of natural sodium sulfate, although 56% of the world's consumption of sodium sulfate compounds was from synthetic sources.

Pushed by a Government policy that encouraged increased mineral exports and by a gradual reprivatization of some of the mining sector, mineral production in 1984 increased significantly. However, production failed to meet domestic demand for many commodities and capacity underutilization continued to be a problem.

Government Policies and Programs.—The new Turkish Government placed emphasis on two main policy areas in 1984. The first was to restore and promote private ownership and investment in the mining sector, and the second was to reduce high fuel import costs by promoting energy conservation and the priority development of domestic energy sources.

Between mid-1983 and late 1984, the Government reduced the number of the large State Economic Enterprises (SEE) from 43 to 21 and encouraged cooperative joint venture projects with the private sector. This reduction was created by the implementation of the decree law of December 28, 1983, which supplemented the Foreign Investment Law No. 6224 of 1954. The changes were designed both to encourage more competition between the SEE and to attract foreign investors. The passing of Decree Law 30 in July 1984 also helped streamline the foreign investment procedures. The Foreign Investment Department can now authorize any investment up to $50 million[2], with projects larger than $50 million requiring approval of the council of ministers. New trade and investment incentives included guarantees to allow capital and profit repatriation; exemption of duties and taxes on imported machinery and equipment; and the deduction of up to 100% of investment allowances and 20% of export earnings from corporate taxes. Also, foreign companies may wholly own subsidiaries with minimum equity requirements dependent on the nature and location of the industry. By yearend 1984, about 267 foreign companies had been given approval for $1.2 billion in foreign investments within the economy.

In the latter half of the year, the Ministry of Energy and Natural Resources proposed 16 amendments to the Government's mining codes that, if passed, would completely restore ownership of mines nationalized by the 1979 law to their former owners.

In the energy sector, the Government was seeking over $5 billion in investments to build a number of large thermal and hydroelectric power projects to reduce its dependency on imports, which currently accounted for 75% of Turkey's energy needs. Only 11% of the estimated potential hydroelectric capacity of 100,000 million kilowatt hours had been tapped. By yearend, four major hydroelectric schemes, Kayraktepek,

Sir, Duzkeme-Berked, and Ataturk, totaling 3,263 megawatts were in the tender stage or being built.

In addition to plans to develop 2,100 megawatts of geothermal power by the year 2000, a $1.5 billion program has been set up to quadruple Turkey's lignite and hard coal mine production for use for domestic heating and in several new planned coal-fired thermal powerplants.

PRODUCTION AND TRADE

Changes in Government policy toward the mineral industries during 1983 and 1984 were beginning to show a positive impact on mineral production in 1984. The return of many mines to the private sector encouraged increased productivity while permitting the Government to concentrate its resources on the improved operation of fewer large state-owned mining and mineral processing facilities.

Substantial increases in production were reported for alumina and aluminum, antimony, barite, boron, cement, chromite, copper, ferrochrome, lead, nitrogenous fertilizers, steel, and zinc. Substantial production declines were experienced in bauxite and tungsten and minor drops in coking coal and crude petroleum while manganese and natural gas output remained the same. Many mining sectors continued to have underutilized capacity and were unable to supply the domestic demand for some minerals, thus aggravating the country's import trade deficit.

The buildup in production was part of a Government-led policy to let exports drive an economic recovery. Aided by Arab investments and loans, many of the mineral exports were directed at satisfying demands of local Middle East markets.

The gross domestic product grew at a rate of 5.9% to approximately $45.9 billion. Total Turkish exports increased by 24.5% to $7.13 billion. Industrial exports led all other sectors at $5.14 billion, of which $240 million was exports of mining products, an increase of 2.6% over that of 1983. Total Turkish imports increased by 16% to $10.76 billion creating a balance of trade deficit of $3.63 billion. Imports of raw materials increased from $6.67 billion to $7.62 billion, of which crude oil imports were $3.37 billion. Although crude oil imports were up 4% over those of 1983, they fell from 35% to 31% as a share of total imports. Export markets for Turkey's principal nonfuel minerals were China, Romania, and Sweden for chromite; Finland, the Netherlands, and the United States for the ferroalloys, principally ferrochrome; and the United States, Western Europe, and Japan for boron materials.

Table 1.—Turkey: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1980	1981	1982	1983[p]	1984[p]
METALS					
Aluminum:					
Bauxite	546,468	589,008	508,392	296,280	128,413
Alumina	137,520	131,400	84,204	57,420	79,125
Metal, primary	33,574	39,985	36,520	32,200	37,900
Antimony:					
Ore, mine output:					
Gross weight	22,029	27,949	35,982	28,000	33,891
Metal content	969	838	1,079	840	203
Regulus	87	45	144	198	412
Chromite:					
Gross weight (34% to 43% Cr_2O_3)	550,719	574,474	616,539	511,464	607,578
Salable product	381,998	422,550	407,697	*330,000	*400,000
Copper:					
Mine output, metal content	26,400	31,881	34,430	25,025	*34,000
Metal:					
Smelter	15,937	27,273	25,313	18,516	32,021
Refined	15,571	24,220	32,200	30,000	*33,000

See footnotes at end of table.

Table 1.—Turkey: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1980	1981	1982	1983[p]	1984[p]
METALS —Continued					
Iron and steel:					
Iron ore, gross weight thousand tons	2,579	2,935	2,855	3,953	4,037
Metal:					
Pig iron and ferroalloys:					
Ferrochromium	e32,000	40,775	39,862	30,175	48,081
Ferrosilicon	--	--	4,300	4,500	6,902
Pig iron and other ferroalloys thousand tons	2,040	1,954	2,329	2,953	3,015
Steel, crude including castings do	2,536	2,363	2,795	3,542	3,900
Lead:					
Mine output, metal content[2]	r7,800	r8,400	10,700	8,900	14,600
Metal, smelter, primary	r2,800	r2,500	3,100	4,000	5,000
Manganese ore, gross weight	41,634	14,937	7,308	3,204	e3,200
Mercury 76-pound flasks	4,437	5,927	7,144	4,699	e4,700
Silver, mine output, metal content[e] thousand troy ounces	200	200	220	220	220
Tungsten, metal content of concentrate	96	153	e150	325	150
Zinc:					
Mine output, metal content[3]	23,300	30,721	31,500	11,100	20,840
Metal, smelter, primary	12,600	18,100	14,900	14,300	19,500
NONMETALS					
Abrasives, natural: Emery	39,940	45,824	35,164	22,846	20,025
Asbestos	18,162	3,860	958	975	e1,000
Barite	128,352	185,555	107,393	76,764	172,900
Boron materials thousand tons	801	843	787	685	1,400
Cement, hydraulic do	12,875	15,043	15,778	13,596	15,738
Clays:					
Bentonite	e20,000	30,687	e31,000	e31,000	28,093
Kaolin	e50,000	44,795	e45,000	e55,000	54,932
Other	e110,000	150,942	152,188	107,865	71,777
Diatomite[e]	9,500	10,000	10,000	9,600	2,540
Feldspar[e]	72,000	70,000	70,000	9,212	NA
Fluorspar[e]	6,000	1,986	2,000	2,000	2,000
Graphite	NA	NA	3,360	3,360	e4,000
Gypsum	e72,200	90,470	90,500	75,572	57,875
Lime thousand tons	1,000	900	900	1,000	e1,000
Magnesite, crude ore	825,876	783,966	905,159	719,484	719,021
Meerschaum kilograms	6,250	17,600	12,850	11,400	15,000
Nitrogen: N content of ammonia	184,000	325,800	306,360	320,000	290,000
Perlite	25,800	45,000	121,527	28,693	60,452
Phosphate rock	21,285	42,500	e35,400	104,482	308,475
Pyrites, cuprous, gross weight	77,272	67,632	e50,000	36,400	e50,000
Salt, all types thousand tons	1,179	1,396	1,313	e1,400	1,290
Sodium compounds, n.e.s.:					
Carbonate[e]	60,000	60,000	60,000	38,835	40,000
Sulfate	88,021	65,822	65,188	53,337	e55,000
Stone, sand and gravel, n.e.s.:					
Limestone thousand tons	90	467	338	342	350
Marble	15,871	36,832	24,110	39,110	40,000
Quartzite	e240,000	197,883	e200,000	239,201	240,000
Sand, siliceous	e60,000	113,826	e110,000	e110,000	110,000
Strontium minerals: Celestite[e]	16,000	15,000	15,000	38,835	35,000
Sulfates, natural, n.e.s.: Aluminum sulfate (alunite)	e6,000	11,543	e11,500	14,682	13,971
Sulfur:					
Native, other than Frasch	23,051	28,270	28,500	e31,000	e39,000
S content of pyrites	33,382	29,217	30,100	e25,000	e25,000
Byproduct	70,000	120,000	126,444	132,000	e135,000
Total	126,433	177,487	185,044	e188,000	e199,000
MINERAL FUELS AND RELATED MATERIALS					
Asphalt, natural thousand tons	559	560	523	e750	e750
Carbon black	15,900	18,108	19,922	e20,000	e20,000
Coal:					
Anthracite thousand tons	2	NA	NA	750	225
Bituminous do	r6,599	r7,630	7,161	6,122	7,103
Lignite do	r16,967	r18,924	20,512	23,723	26,825

See footnotes at end of table.

Table 1.—Turkey: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1980	1981	1982	1983[P]	1984[P]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Coke and semicoke:					
Metallurgical thousand tons	1,928	1,875	2,102	2,380	2,401
Gashouse[e] do	300	250	300	121	100
Breeze[e] do	125	100	125	260	174
Total do	2,353	2,225	2,527	2,761	2,675
Gas, natural:					
Gross million cubic feet	30,000	[e]29,000	26,050	[e]27,000	[e]27,000
Marketed[e] do	[3]1,000	3,000	3,500	3,500	3,500
Petroleum:					
Crude thousand 42-gallon barrels	16,682	16,918	16,697	15,779	14,941
Refinery products:					
Gasoline do	16,131	16,341	15,140	16,956	18,380
Jet fuel do	1,165	1,716	2,360	2,263	2,472
Kerosine do	3,682	2,386	2,035	2,375	2,593
Distillate fuel oil do	36,891	38,557	43,580	47,664	50,570
Residual fuel oil do	20,682	23,431	26,490	34,178	38,433
Lubricants do	1,200	[e]1,000	[e]1,100	1,563	1,486
Liquefied petroleum gas do	4,324	3,742	3,430	4,865	5,585
Naphtha do	114	[e]210	[e]210	226	58
Asphalt do	1,615	2,177	1,875	2,534	2,960
Unspecified do	3,547	3,814	4,480	7,532	9,787
Refinery fuel and losses do	[e]1,200	[e]1,200	1,200	1,905	2,248
Total do	90,551	94,574	101,900	122,061	134,572

[e]Estimated. [P]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through May 8, 1985. Limestone quarried for cement manufacture is substantial; however, information is inadequate to make accurate estimates of output levels.

[2]Includes Pb content of lead ores and mixed ores known to to be intended for treatment for lead recovery.

[3]Includes Zn content of zinc and lead-zinc ores but excludes Zn content of lead ore.

[4]Run-of-mine ore contains 27% P_2O_5.

[5]Reported figure.

Table 2.—Turkey: Exports of selected mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1982	1983	Destinations, 1983	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	31,686	57,332	--	France 44,330; United Kingdom 7,700.
Metal including alloys:				
Unwrought	1,006	1,244	--	All to Iran.
Semimanufactures	12,868	19,355	--	Iran 11,146; Kuwait 2,559; Saudi Arabia 1,289.
Arsenic: Ore and concentrate	6	--	--	
Chromium: Ore and concentrate	303,821	362,668	--	China 124,300; Romania 62,134; Sweden 44,325.
Copper: Metal including alloys:				
Unwrought	--	18	--	All to Belgium-Luxembourg.
Semimanufactures	2,991	11,678	85	Iran 10,602.
Iron and steel: Metal:				
Scrap	13	219	--	West Germany 100; Netherlands 48; Libya 35.
Pig iron, cast iron, related materials	255	16,052	--	North Korea 15,999.
Ferroalloys	38,040	32,825	20,383	Netherlands 6,400; Finland 3,000.
Steel, primary forms	59,451	132,911	--	Iran 65,098; West Germany 23,383.
Semimanufactures:				
Bars, rods, angles, shapes, sections	602,116	730,763	--	Iran 614,780; Iraq 72,061.
Universals, plates, sheets	24,696	47,139	--	Iran 40,821; Iraq 5,716.
Hoop and strip	322	6,537	--	Iran 2,580; Iraq 913.
Wire	16,307	3,314	--	Iraq 2,487.
Tubes, pipes, fittings	114,448	134,374	98	Iran 120,645.
Castings and forgings, rough	2,814	5,440	3	Iraq 2,352; Libya 1,627.
Lead:				
Ore and concentrate	2,022	2,725	--	Italy 1,725; Bulgaria 1,000.
Oxides	--	109	--	France 99; United Kingdom 10.
Metal including alloys:				
Unwrought	--	7	--	Libya 6.
Semimanufactures	72	107	--	Libya 103.

See footnote at end of table.

Table 2.—Turkey: Exports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1982	1983	Destinations, 1983	
			United States	Other (principal)
METALS —Continued				
Manganese: Oxides	--	320	25	United Kingdom 150; Belgium-Luxembourg 80; West Germany 65.
Mercury 76-pound flasks	9,195	7,020	1,392	Netherlands 5,570.
Silver: Metal including alloys, unwrought and partly wrought value, thousands	$16	$38	--	All to West Germany.
Titanium: Oxides	--	2,250	3	West Germany 1,232; Czechoslovakia 460.
Tungsten:				
Ore and concentrate	--	180	--	West Germany 87; United Kingdom 75.
Metal including alloys, all forms	29	305	180	Austria 120.
Uranium and thorium: Metal including alloys, all forms value, thousands	$2	$3	--	All to West Germany.
Zinc:				
Ore and concentrate	750	1,200	--	All to Bulgaria.
Oxides	--	100	--	All to Netherlands.
Metal including alloys, unwrought	--	183	--	All to Iran.
Other:				
Ores and concentrates	610	330	--	France 270; West Germany 60.
Base metals including alloys, all forms	201	601	--	Netherlands 220; Belgium-Luxembourg 140.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	27,077	22,913	--	France 14,108; Netherlands 5,100; United Kingdom 3,240.
Grinding and polishing wheels and stones	75	320	--	Saudi Arabia 148; Jordan 123.
Barite and witherite	171,484	162,580	12,216	Switzerland 67,232; U.S.S.R. 34,600; Trinidad and Tobago 11,818.
Boron materials:				
Crude natural borates	419,210	622,537	100,300	Italy 120,426; United Kingdom 48,823; Japan 43,180.
Oxides and acids	13,128	7,022	3,000	West Germany 1,126; Romania 1,000.
Cement thousand tons	4,125	2,284	--	Algeria 685; Libya 355; Egypt 313.
Chalk	5,866	3,174	--	Iraq 1,124; Lebanon 1,000; Libya 700.
Clays, crude	65,162	64,183	--	Romania 48,988; U.S.S.R. 5,200.
Diatomite and other infusorial earth	138	15	--	All to West Germany.
Feldspar, fluorspar, related materials	3,048	5,045	--	Lebanon 3,000; Kuwait 1,490.
Fertilizer materials: Manufactured:				
Ammonia	86	668,424	107,155	U.S.S.R. 379,102; Libya 75,693; Venezuela 45,996.
Phosphatic	257,436	77,951	--	China 33,800; Saudi Arabia 21,951; Egypt 12,200.
Unspecified and mixed	3,864	15,000	--	Nigeria 6,000; China 5,000.
Gypsum and plaster	254	2,651	--	Libya 1,598; Lebanon 608; Egypt 350.
Lime	6,806	2,638	--	Iraq 1,960; Kuwait 453.
Magnesite	135,733	92,070	3,676	U.S.S.R. 49,378; Austria 19,924; West Germany 5,090.
Meerschaum, amber, jet	3	5	--	Italy 4; Austria 1.
Mica: Crude including splittings and waste	20	20	--	All to Kuwait.
Pigments, mineral:				
Natural, crude	177	197	--	United Kingdom 177; Iraq 20.
Iron oxides and hydroxides, processed	--	381	--	West Germany 354; Japan 21.
Precious and semiprecious stones other than diamond: Synthetic value, thousands	$24	--	--	
Pyrite, unroasted	301	15	--	All to Iraq.
Salt and brine	28,634	6,258	--	Iraq 5,546; Bulgaria 500.
Sodium compounds, n.e.s.: Manufactured:				
Carbonate	51,957	61,883	--	Iran 17,335; Algeria 13,600; Greece 10,784.
Sulfate	53,608	55,758	--	Italy 31,850; Netherlands 6,941; Switzerland 3,321.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	39,325	40,739	79	Libya 9,279; Saudi Arabia 7,205; Italy 5,051.
Worked	7,538	8,704	68	Libya 4,265; Saudi Arabia 2,140.
Dolomite, chiefly refractory-grade	153	74	--	Iraq 50; Greece 24.
Gravel and crushed rock	12,068	8,965	--	Iraq 4,523; Libya 2,007.
Limestone other than dimension	300	515	--	All to Iraq.
Quartz and quartzite	109	160	--	Iran 100; Iraq 51.
Sand other than metal-bearing	601	750	--	All to Libya.
Sulfur: Sulfuric acid	100	--	--	
Talc, steatite, soapstone, pyrophyllite	987	679	--	Iraq 330; Libya 300.

See footnote at end of table.

Table 2.—Turkey: Exports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1982	1983	Destinations, 1983	
			United States	Other (principal)
NONMETALS —Continued				
Other:				
Crude	20,600	40,223	--	West Germany 32,185; U.S.S.R. 5,000.
Slag and dross, not metal-bearing	--	18,617	--	Greece 8,295; Israel 6,350; United Kingdom 2,150.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	536	72	--	Jordan 40; Libya 19; Iraq 13.
Carbon black	500	575	--	All to Iraq.
Coal: Anthracite and bituminous	4,450	--		
Coke and semicoke	62	--		
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	1,526	2,943	--	Italy 1,949; France 646; Greece 205.
Refinery products:				
Gasoline, motor do	2,558	1,813	--	Italy 1,133; Greece 593.
Kerosine and jet fuel do	1,429	919	--	Italy 509; Egypt 374.
Distillate fuel oil do	299	17	--	All to Iraq.
Lubricants do	3	4	--	Iraq 2; Italy 1.
Residual fuel oil do	4,868	1,012	--	Italy 1,011.
Bituminous mixtures do	9	1	--	Mainly to Iraq.

[1]Table prepared by Virginia A. Woodson.

Table 3.—Turkey: Imports of selected mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1982	1983	Sources, 1983	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	--	1,025	--	Italy 1,000; Netherlands 25.
Oxides and hydroxides	330	258	(2)	West Germany 208; Switzerland 34.
Metal including alloys:				
Unwrought	35,102	59,953	445	Spain 33,208; Canada 9,186; Italy 3,111.
Semimanufactures	1,110	915	8	West Germany 557; Switzerland 79; Poland 50.
Arsenic: Oxides and acids	90	150	--	Belgium-Luxembourg 80; United Kingdom 46.
Chromium:				
Ore and concentrate	1	11	--	All from United Kingdom.
Oxides and hydroxides	244	308	--	Poland 92; Italy 63; West Germany 50.
Cobalt: Oxides and hydroxides	42	60	--	Belgium-Luxembourg 40; Switzerland 5; Canada 4.
Copper:				
Ore and concentrate	--	16,202	--	Morocco 10,202; Bulgaria 6,000.
Matte and speiss including cement copper	211	50	--	All from France.
Metal including alloys:				
Scrap	2,697	928	500	West Germany 122; Netherlands 83.
Unwrought	6,164	26,110	754	Chile 13,686; Belgium-Luxembourg 4,660; Netherlands 1,364.
Semimanufactures	8,499	10,820	6	West Germany 4,758; United Kingdom 2,354; Italy 846.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	1,171	1,329	57	Brazil 540; Sweden 391; Liberia 182.
Pyrite, roasted do	4	--		

See footnotes at end of table.

Table 3.—Turkey: Imports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1982	1983	Sources, 1983	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal:				
Scrap ——— thousand tons	1	1	1	
Pig iron, cast iron, related materials ——— do	52	68	(2)	Brazil 26; Italy 11; United Kingdom 10.
Ferroalloys:				
Ferromanganese ——— do	30	21	4	Republic of South Africa 6; Brazil 3; Norway 3.
Unspecified ——— do	10	22	(2)	Norway 7; U.S.S.R. 3; Brazil 2.
Steel, primary forms ——— do	304	929	6	Netherlands 112; U.S.S.R. 109; Bulgaria 104.
Semimanufactures:				
Bars, rods, angles, shapes, sections ——— do	127	103	(2)	West Germany 27; Romania 22; Belgium-Luxembourg 7.
Universals, plates, sheets ——— do	366	317	2	Japan 52; West Germany 50; Bulgaria 35.
Hoop and strip ——— do	5	3	(2)	West Germany 1; Austria 1.
Rails and accessories ——— do	11	10	--	Republic of South Africa 9.
Wire ——— do	4	2	(2)	Belgium-Luxembourg 1; West Germany 1.
Tubes, pipes, fittings ——— do	77	43	2	West Germany 16; United Kingdom 7; Japan 6.
Castings and forgings, rough ——— do	17	5	(2)	U.S.S.R. 4; West Germany 1.
Lead:				
Oxides	100	109	--	France 99; United Kingdom 10.
Metal including alloys:				
Unwrought	3,828	8,735	442	Spain 3,863; Bulgaria 938; United Kingdom 868.
Semimanufactures	43	1	--	Mainly from United Kingdom.
Magnesium: Metal including alloys:				
Unwrought	84	124	20	Norway 44; Switzerland 22; France 20.
Semimanufactures value, thousands	$656	$10	--	Switzerland $6; West Germany $4.
Manganese:				
Ore and concentrate, metallurgical-grade	1,952	1,910	--	Belgium-Luxembourg 1,871; United Kingdom 29.
Oxides	580	320	25	United Kingdom 150; Belgium-Luxembourg 80; West Germany 65.
Nickel:				
Matte and speiss	443	651	20	Canada 212; United Kingdom 194; Belgium-Luxembourg 67.
Metal including alloys:				
Unwrought	1	29	--	All from Netherlands.
Semimanufactures	121	155	5	West Germany 110; Canada 14; Switzerland 11.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$477	$360	--	Italy $235; West Germany $103.
Silver: Metal including alloys, unwrought and partly wrought ——— do	$361	$356	$1	West Germany $322; Switzerland $31.
Tin:				
Oxides	2	3	--	West Germany 2.
Metal including alloys:				
Unwrought	657	995	--	United Kingdom 299; Malaysia 261; Netherlands 154.
Semimanufactures	7	4	--	West Germany 3; United Kingdom 1.
Titanium: Oxides	1,746	2,250	3	West Germany 1,232; Czechoslovakia 460.
Tungsten: Metal including alloys, all forms	7	5	--	West Germany 2; Netherlands 1; United Kingdom 1.

See footnotes at end of table.

Table 3.—Turkey: Imports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1982	1983	Sources, 1983	
			United States	Other (principal)
METALS —Continued				
Zinc:				
Oxides	542	250	--	West Germany 243; France 7.
Blue powder	--	29	--	All from West Germany.
Metal including alloys:				
Unwrought	6,184	7,910	--	Bulgaria 2,980; Italy 1,286; United Kingdom 1,199.
Semimanufactures	14	--		
Other:				
Ores and concentrates	3,009	3,894	200	Australia 1,798; Sweden 1,000.
Oxides and hydroxides	211	482	--	France 147; West Germany 110; United Kingdom 85.
Base metals including alloys, all forms	NA	142	4	Netherlands 72; United Kingdom 32; France 20.
NONMETALS				
Abrasives, n.e.s:				
Artificial: Corundum	1,189	1,490	--	West Germany 739; Czechoslovakia 432; Poland 257.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$337	$295	$101	Netherlands $74; United Kingdom $52.
Grinding and polishing wheels and stones	309	274	1	Italy 127; West Germany 69; Norway 40.
Asbestos, crude	20,012	20,575	1,000	U.S.S.R. 8,021; Republic of South Africa 3,368; Switzerland 3,289.
Boron materials: Oxides and acids	7	2	(2)	West Germany 1.
Cement	1,810	1,594	--	West Germany 1,111; United Kingdom 195; France 146.
Chalk	10	--		
Clays, crude	7,551	4,259	1,041	United Kingdom 2,672; West Germany 289.
Cryolite and chiolite	22	20	--	All from Denmark.
Diamond: Industrial stones value, thousands	$1,162	$455	$31	United Kingdom $349; Republic of South Africa $53.
Diatomite and other infusorial earth	337	73	23	Italy 50.
Feldspar, fluorspar, related materials	81	23	--	West Germany 20; Sweden 3.
Fertilizer materials: Manufactured:				
Ammonia	364,115	668,424	107,155	U.S.S.R. 379,102; Libya 75,693; Venezuela 45,996.
Nitrogenous	399,302	916,617	35,842	Romania 545,933; Italy 137,804; Yugoslavia 50,679.
Potassic	56,931	38,381	--	Israel 23,392; Belgium-Luxembourg 5,500; Switzerland 5,489.
Unspecified	195	148,561	91,304	Belgium-Luxembourg 27,969; Spain 15,518.
Graphite, natural	326	334	--	All from West Germany.
Magnesite	296	60	1	Austria 47; West Germany 10.
Mica:				
Crude including splittings and waste	23	39	--	West Germany 31; Netherlands 5.
Worked including agglomerated splittings	44	63	--	Spain 24; Belgium-Luxembourg 8; West Germany 6.
Phosphates, crude	625,537	922,641	--	Tunisia 247,356; Jordan 239,787; Morocco 23,979.
Pigments, mineral: Iron oxides and hydroxides, processed	245	381	--	West Germany 354; Japan 21.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$82	$19	--	West Germany $17; Italy $2.
Synthetic do	$65	$20	--	Switzerland $13; East Germany $4.
Pyrite, unroasted	70,427	89,995	--	Norway 40,000; Spain 23,284; Albania 11,209.
Salt and brine	67	81	--	All from West Germany.
Sodium compounds, n.e.s.: Manufactured:				
Carbonated	38,853	20,140	5	Bulgaria 15,074; Spain 1,995.
Sulfate	53,608	55,758	--	Italy 31,850; Netherlands 6,941; West Germany 2,599.

See footnotes at end of table.

Table 3.—Turkey: Imports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1982	1983	Sources, 1983	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel:				
Quartz and quartzite	107	266	--	West Germany 153; Switzerland 55.
Sand other than metal-bearing	1,693	33	--	United Kingdom 29; West Germany 4.
Sulfur:				
Elemental:				
Crude including native and by-product	114,696	76,878	--	Saudi Arabia 39,113; Kuwait 16,840; Poland 14,460.
Colloidal, precipitated, sublimed	90	140	--	West Germany 62; United Kingdom 68; France 20.
Sulfuric acid	18	73,539	--	Japan 29,788; Switzerland 26,849; Spain 14,690.
Talc, steatite, soapstone, pyrophyllite	227	321	--	West Germany 299; Belgium-Luxembourg 22.
Other: Crude	1,469	2,030	--	West Germany 1,010; United Kingdom 834.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	69	40	40	
Carbon black	5,852	7,701	46	Italy 4,935; West Germany 2,157.
Coal:				
Anthracite and bituminous thousand tons	1,033	902	882	Australia 39.
Briquets of anthracite and bituminous coal	4,978	33	33	
Lignite including briquets	24,825	11,831	--	All from Republic of South Africa.
Coke and semicoke	65,035	78,919	--	Netherlands 46,515; Belgium-Luxembourg 13,292; Italy 13,000.
Petroleum:				
Crude thousand 42-gallon barrels	13,862	102,665	--	Iran 39,441; Iraq 29,143; Libya 22,967.
Refinery products:				
Liquefied petroleum gas do.	(3)	1,969	--	Kuwait 1,918.
Gasoline, motor do.	3	48	--	All from Italy.
Distillate fuel oil do.	103	4,786	--	U.S.S.R. 2,321; Romania 1,102; Bulgaria 859.
Lubricants do.	13	113	26	United Kingdom 29; Belgium-Luxembourg 16; Netherlands 14.
Residual fuel oil do.	258	3,019	681	Iran 1,730; Romania 401.
Bituminous mixtures do.	20	98	94	Netherlands 2.
Petroleum coke do.	72	807	266	Syria 541.

NA Not available.
[1]Table prepared by Virginia A. Woodson.
[2]Less than 1/2 unit.
[3]Value only reported at $123,752,000.

COMMODITY REVIEW

METALS

Aluminum.—A continued shortage of energy supplies kept aluminum metal production at an estimated 60% of capacity. As a consequence, Turkey has had to more than double imports to meet demand since 1981. However, Turkey's 85% increase in investment in the energy sector was expected to permit the Seydisehir smelter to operate closer to its 60,000-ton-per-year capacity in 1985. Negotiations continued with the Soviet Union to develop terms to increase aluminum capacity by an additional 30,000 tons per year. Etibank (the industry monopoly established by the Government in 1979) reportedly wanted the Soviet Union to guarantee to import 80,000 tons per year of alumina between 1986 and 1988 as part of any agreement. Joint venture negotiations were also under way between Etibank and the Dubai Aluminium Co. Ltd. to build a $170 million, 250,000-ton-per-year alumina plant to process bauxite ore from the mines in the Milas region.

Chromite.—Production of chromite increased 19% for the year although the industry operated at only 73% of its full

operating mine capacity of 218,000 tons of contained chromium in chromite ore per year. Reserves of chromite in Turkey were estimated at 4.5 million tons of contained chromium, equal to less than 1% of world reserves. In 1984, Turkey ranked fourth and sixth in world production and reserves of chromite, respectively.

Chromite was mined in five main areas. In order of importance, these were the Guleman-Elazig area in eastern Turkey, the Fethiye-Koycegiz area in southwestern Turkey, the Bursa-Orhaneli region in the northwest, the Pozanti-Karsanti region in the south-central part of the country, and Kopdag area in north-central Turkey.

Etibank, with five concentrators at Karagedik in the Fethiye region and at Sori and Kefdag in the Guleman region of Elazig Province, was the principal producer. The remainder of chromite output came from private sector mine operators. Etibank also operated the country's only two ferrochrome smelters, a 20,000-ton-per-year low-carbon ferrochrome plant at Antalya and a 50,000-ton-per-year high-carbon ferrochrome plant at Elazig. In 1984, Etibank increased ferrochrome production by 54% by making more chromite concentrates available to the underutilized Elazig plant.

Copper.—Phelps Dodge of Turkey Inc., an exploration subsidiary of the U.S. copper company Phelps Dodge Corp., earned a 49% interest in the Cayeli zinc-copper-silver-gold deposit by funding a program of drilling bulk sampling and metallurgical testing and the completion of a preliminary feasibility study at a cost of over $3 million. In 1983, a Turkish company, Cayeli Bakir AS, was formed by Etibank, Phelps Dodge of Turkey, and Gama Industries TAS, a private Turkish company, to hold and develop this deposit. Development costs were estimated at $150 million.

A similar $60 million joint venture agreement was also signed in 1984 between Etibank and Preussag AG of the Federal Republic of Germany to develop the Siirt-Madenkoy copper deposit in the southeast corner of Turkey. Preliminary plans called for a mine capable of producing 300,000 tons of copper ore per year.

Iron Ore.—Turkiye Demir ve Celik Isletmeleri (TDCI), the Turkish iron and steel works, a 100% Government-owned enterprise, controlled over three-quarters of domestic iron ore production, principally through its Divirigi Mine at Sias in the Malataya region of central Turkey. The continued growth in iron ore output to over 4 million tons was attributed to the concentration of Government resources and efforts at the Divirigi Mine and to increases in output from the smaller mines that had been returned to private sector ownership.

Iron and Steel.—TDCI had a total or partial interest in Turkey's three largest steel mills at Tskenderun, Karabuk, and Eregli. The three mills had a combined capacity of 4.5 million tons of steel per year. The private sector controlled about 25% of domestic capacity, and this share was expected to grow. Production of crude steel was estimated for 1984 at 3.9 million tons or about 65% of installed capacity. Both production levels and capacity were expected to increase in response to a growing domestic demand related to the Government's energy and other economic development projects. There was also a need to reduce primary and semimanufactured steel exports which increased in 1983. The Fifth Development Plan, approved in July 1984, planned for an increase in crude steel capacity to 8 million tons per year by 1989.

Lead and Zinc.—The industry was comprised of two companies. Cinko-Kursun Metal Saniyii AS (Cinkur) with a smelter at Kayseri was owned 47% by Etibank and 53% by private interests. The second company, Keban Lead and Zinc Works, was at Elazig and could process 10,000 tons per year of lead-zinc concentrate. A comprehensive technical journal article described the 1977-83 operating results and a flowsheet of the Cinkur smelter.[3] In 1977, two pyrometallurgical process Waelz kilns were installed at the zinc smelter to treat the zinc-lead oxide ores of the Zamanti District. The Waelz plant was designed to treat 240,000 tons of ore per year averaging 21.82% zinc, 2.1% lead, and 0.007% cadmium. The process used a rotary kiln to recover metal values through volatilization. Coke breeze, fuel oil, limestone, and bituminous coal from the Zonguldak coal deposit were used to reduce the oxide ores at 1,100° C to 1,200° C kiln temperatures. In 1983, the plant treated 109,535 tons of ore grading 20.14% zinc yielding 34,378 tons of a 54.5% zinc concentrate. This represented an 85.0% recovery with a loss of 2.8% zinc in the slag. The article noted that the zinc and lead grades in the Waelz oxide product were below design levels and impurities were high; however, a recirculating of material collected in the first and second radiation coolers served to upgrade the final oxide

product.

Plans were announced to spend $37.5 million to expand and modernize the Balikesir-Balya lead-zinc mine to produce 300,000 tons per year of ore from reserves estimated at 7.4 million tons. Costs were to be shared between Etibank, Metallgesellschaft AG of the Federal Republic of Germany, and Demir Export Ltd.

NONMETALS

Boron.—During August, the new sodium borate processing plant at Kirka in west-central Turkey began producing pentahydrate borax and by yearend was also producing anhydrous borax. The plant capacities were reported to be 160,000 tons per year of pentahydrate and 60,000 tons per year of anhydrous borax. Prior to startup of the Kirka plant, all borate processing was accomplished at facilities at the port city of Bandirma, on the coast of northwestern Turkey. Finished products from the Kirka plant were being shipped by rail to handling and storage facilities at the port of Bandirma. Almost all of Turkey's annual borate concentrate and derivative chemical production was exported in 1984, making Turkey the world's largest exporter of boron products. The Kirka plant and continued expansion of existing boron chemical facilities at Bandirma reaffirmed the Government's commitment to converting borates into higher valued chemicals prior to export. Ore feedstock for processing at the Kirka plant was coming entirely from the nearby Kirka Mine, which in 1984 produced approximately 450,000 tons of ore yielding 300,000 tons of concentrate. The Kirka area had proven reserves in the north of 480 million tons of ore graded 27% boric oxide (B_2O_3) and smaller tonnages of ore graded 42% B_2O_3 in the south. The Kirka area also contained the only known commercial sodium borate deposits in Turkey. Other major commercial borate deposits, mainly calcium-based colemanite, were at Emet, Bigadic, and Kestelek. The existing borate mines of Turkey were basically restricted to the western part of the country and continued to be operated in 1984 by Etibank. Although all borate mines were nationalized in 1979, former private sector producers had until January 1, 1985, to sell or trade whatever borate stocks they had in their possession prior to nationalization.

Cement.—During the year, three new plants built by the Government agency Turkiye Cimento Sanayii TAS (Cisan) began operations. Included were a plant at Lanik with a clinker capacity of 580,000 tons per year that went on-stream in January; a 590,000-ton-per-year clinker plant at Siirt that began operations during the first quarter of 1984; and a plant at Ergani that started up operations in midyear. Several other cement plants were still under construction at yearend. The three nearest completion were a planned 550,000-ton-per-year plant at Urfa, scheduled for startup in 1985; a planned 550,000-ton-per-year plant at Edirne scheduled to come on-stream during 1986; and a 600,000-ton-per-year plant at Denizli, scheduled on-line in 1986. Dyckerhoff Engineering GmbH was handling the engineering consulting on the plant construction projects, and Humboldt Wedag was supplying the plant equipment. All six of the new Cisan plants mentioned were equipped or to be equipped with identical equipment, with minor exceptions made for varying altitude constraints and raw material properties. Completion of the new plants would increase the number of operating Cisan plants to 26. Upon completion of the plants still under construction at yearend, the cement manufacturing capacity of Turkey would increase to almost 25 million tons annually, with the Government and private sector portions of the industry each contributing about one-half the total capacity. Approximately 60% of Turkey's cement output in 1984 came from approximately 20 privately owned and operated manufacturing facilities within the country.

Fertilizer Materials.—A project to modernize Turkey's fertilizer manufacturing industry continued throughout 1984. Assisted by a $44 million loan from the International Bank for Reconstruction and Development (World Bank) granted in 1982, the project was increasing manufacturing capacities and modernizing existing sulfuric and phosphoric acid facilities within Turkey. A program has begun to increase fertilizer utilization rates within Turkey's agricultural industry. Fertilizer consumption was expected to increase 50% over the 5-year period 1984-89. An important part of the World Bank-sponsored project was to reopen the ISKUR sulfuric and phosphoric acid manufacturing plant in Bandirma. Commissioned in 1981, the plant went into bankruptcy in 1983 and closed, forcing its sole customer of downstream fertilizer products, Bandirma Gubre Fabrikalari AS, to import its feedstock requirements of sulfuric and phosphoric acid. ISKUR was manu-

facturing almost 150,000 tons per year of phosphoric acid, one-half of the country's domestic production. Almost all of the raw materials for Turkey's fertilizer industry were imported in 1984. Etibank operated the only phosphate rock mine in the country at Mazidagi near the Syrian border. Opened in 1976, the mine had yet to exceed 50,000 tons per year of produced concentrate. Etibank continued also to be the only domestic primary sulfur producer in Turkey during 1984, with a small native sulfur mine at Keciborlu producing about 30,000 tons annually.

A decision was announced in midyear by the Turkish Government to build a fourth fertilizer complex within the country, in the Province of Cukutova near the town of Mersin. The proposed complex was to comprise facilities for the production of 1,400 tons per day of diammonium phosphate (DAP), 1,500 tons per day of ammonium nitrate, and 1,150 tons per day of nitric acid. The project plans were being developed by the state fertilizer agency Azot Sanayii TAS. An estimated 60% of the proposed financing for the project was to come from foreign interests, with potential financial partners being Petro-Chemical Industries Co. of Kuwait, Le Groupe Chimique Tunisien of Tunisia, and the Arab Groupe Petroleum Investments Corp. Capacity plans for the complex included an initial production of 400,000 tons per year of DAP and 500,000 tons per year of ammonium nitrate, with further product diversification expected in the 1990's. The facilities were expected to take 4 years to construct at an estimated cost of $220 million, with construction beginning before the end of 1985.

The Spanish engineering firm Técnicas Reunidas, upon Government approval, was awarded a contract in midyear to build a nitrogen-phosphorus (NP) plant at Ceyhan in eastern Turkey. The new plant was to be added to the existing fertilizer facilities at the site operated by the Turkish fertilizer company Toros Fertilizer & Chemicals Co. Capacity of the plant was to be either 1,600 tons per day of DAP, or alternatively 1,000 tons per day of 20-20 NP. The plant was expected to be completed before yearend 1985. A new process involving low recycling of raw materials was to be incorporated into the plant. A reported advantage of the process was that 98% of the phosphorus pentoxide was produced in water soluble form instead of the conventional 92% of traditional DAP manufacture.

MINERAL FUELS

Coal.—During the first quarter of 1984, a guarantee for a $184 million coal-development loan was secured by the Turkish Government from the Export-Import Bank. The loan was to be used for purchasing coal mining equipment from manufacturers in the United States. The Turkish Government-owned coal mining enterprise, Turkiye Komuleri Isletmeri, was expected to purchase draglines, excavators, bulldozers, dump trucks, and other pieces of equipment for its lignite mining operations in eastern and western Turkey.

Completion work continued throughout the year on the 1.7-gigawatt Elbistan-A powerplant, built at an estimated completion cost of over $1,800 million. The plant was the first of four powerplants originally planned for the Elbistan area, which contained proven reserves of 1.8 billion tons of lignite coal. The actual cost versus estimated cost of building the plant trebled over the years of its construction, and subsequently the Turkish Government was envisioning a considerably slower pace of construction for the Elbistan power station than originally scheduled. Another high cost factor for mine-mouth power generation utilizing the Elbistan lignite coal deposits was the long power transmission distance from the Elbistan area in eastern Anatolia to the industrialized population centers in western Turkey. A United Nations Development Program study, completed early in 1984, proposed a careful reassessment of the economics of the remaining three planned Elbistan powerplants and suggested feasibility studies for building the powerplants closer to western customers, and alternatively railing in Elbistan lignite coal or importing necessary coal supplies, or some combination of these alternatives.

Natural Gas.—All of Turkey's nonassociated gas production was produced by the state-owned petroleum company, Turkiye Petrolleri Anonim Ortakliki (TPAO). Gas continued to be produced from two main areas: the Thrace Basin in northwestern Turkey on the European side of the Bosphorus and from the southeastern part of the country at Marlin-Camurlu within the Hakkari Basin. Marketed natural gas production from the Hakkari Basin began in 1976 and from the Thrace Basin in 1982. Completion and connection of new gas wells and expansion of a pipeline collection and distri-

bution system for the Hamitabad Gasfield continued throughout 1984. Plans were to transport gas supplies to the eastern shore of the Marmara Sea for use as feedstock in two fertilizer plants, and to the northern shore of the sea for use as fuel in a powerplant that was estimated to have consumed $500,000 per day of imported fuel oil to generate electricity in 1984.

With the financial assistance of a $55 million loan from the World Bank, the Government of Turkey continued all year with an ambitious natural gas exploration program in the country's western Thrace Basin. A considerable portion of Turkey's marketed gas came from within the Thrace Basin, specifically from the Hamitabad Field. The basin's share of the country's annual gas production was expected to increase steadily over the remainder of the 1980's. TPAO was to provide almost $44 million in financing for the project, bringing the total project funds to almost $100 million. There had been several additional gas discoveries in the basin since the discovery of the Hamitabad Field in 1982, and project officials expected proven reserves for the basin to reach 1 trillion cubic feet. Also as part of the project, 1,100 miles of seismic survey and 11 wildcat wells were to be completed during the period 1984-86. Other ongoing aspects of the project were geological and sedimentological studies and technical assistance to TPAO.

Petroleum.—Changes made in 1980 within Turkey's economic system that liberalized investment and, in particular, changes made in the 1983 petroleum law that encouraged oil exploration and production, resulted in substantially increased activity within the petroleum exploration sector in 1984. Since passage of Law-2808 in March 1983, several foreign petroleum companies had either signed exploration contracts with Turkey's TPAO or were, by yearend 1984, negotiating for concessions. In addition to exploration being carried out by TPAO, Mobil Exploration Mediterranean Inc., Royal Dutch/Shell NV, and Roy M. Huffington Co. were drilling wells in 1984. TPAO drilled 15 wells in the Cemberlitas Field of southeastern Turkey's Adiyaman Province during the year and tapped high gravity oil in 6 of them. The results were encouraging enough that seven more exploration wells were to be drilled in 1985. The Cemberlitas Field had been closed down in the early 1970's after initial exploration efforts proved disappointing.

In the latter part of 1984, Amoco Turkey Petroleum Co. signed a joint venture contract with TPAO and began exploration work on a 1.7-million-acre concession in the Hakkari Basin. Based on seismic studies, the company could begin exploration drilling as soon as mid-1985. The Amoco concession was in mountainous terrain on the easternmost portion of a thrust belt, and exploration was expected to be difficult. Also awarded to Amoco was one onshore block and five onshore and offshore blocks in westernmost Turkey in an area between Kusadasi and Edremit. All together, the six blocks covered an area of 711,322 acres. With low onshore elevations and shallow offshore waters, Amoco expected exploration to be relatively trouble free. No startup date for the western concession exploration work was set by yearend.

Two wells were drilled during the year under a joint venture between TPAO and Salen Energy AB of Sweden, in a concession area that included Iskenderun Bay. Both wells were abandoned, although one yielded a noncommercial volume of light oil. TPAO extended Salen's contract until August 31, 1985, and Salen hoped to begin drilling a third well during the first half of 1985. A consortium of United States, Canadian, and Norwegian firms led by Seahawk Oil International Inc. of California completed geophysical work in the Saros Bay region. Initial geophysical studies were completed by Barrick Petroleum Corp. of Toronto, Canada, in the eastern and central Black Sea area and the onshore Sinop and Samsum Basins, and drilling program plans were being developed at yearend. Geophysical information on the Salt Lake Basin of central Turkey was being studied by the Scottish firm Lennox Oil Co. TPAO and the Atlantic Richfield Co. of the United States signed a letter of intent in late 1984 and were expected to finalize a joint venture exploration agreement for a concession area in the central thrust belt early in 1985. Another possible exploration program for a thrust belt concession in 1985 was being negotiated between TPAO and Occidental Petroleum Corp. of the United States. During 1984, TPAO concluded two exploration contracts for concession areas in southeastern Turkey with Shell International Petroleum Co. Also negotiating with TPAO at yearend were Denison Mines Ltd. of Toronto, Canada, and Texaco Inc. of the United States, concerning possible exploration in Adana Bay.

[1]Physical scientist, Division of International Minerals.
[2]Where necessary, values have been converted from Turkish lira (TL) to U.S. dollars at the rate of TL366.68 = US$1.00.
[3]Dogan, Z. Cinkur's Waelz Plant in Turkey: Operational Results and Problems. Min. Mag. (London), v. 151, No. 2, Aug. 1984, pp. 98-103.

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